IL-10,620

S-94,206

```
int MPI_Send(void* buf, int count, MPI_Datatype datatype, int dest, int tag, MPI_Comm comm)
int MPI_Recv(void* buf, int count, MPI_Datatype datatype, int source, int tag, MPI_Comm comm, MPI_Status *status)

int MPI_Isend(void* buf, int count, MPI_Datatype datatype, int dest, int tag, MPI_Comm comm, MPI_Request *request)
int MPI_Irecv(void* buf, int count, MPI_Datatype datatype, int source, int tag, MPI_Comm comm, MPI_Request *request)
int MPI_Wait(MPI_Request *request, MPI_Status *status)
```

FIG. 1

Wrapper

```
extern int  MPI_Send(  void *buf , int count , MPI_Datatype datatype ,
          int dest , int tag , MPI_Comm comm )
{
     int res = 0;
     INT64 duration=0;
     u_TIMESTRUCT start,end;
     u_GETTIME(&start);
     res = PMPI_Send( buf, count, datatype, dest, tag, comm );
     u_GETTIME(&end);
     duration = u_GETTIMEDIFF(&end,&start);

     /* package event structure and write it to memory buffer */

     return res;
}
```

Event Record

```
<1082> MPI_Send {
     int64 timestamp[1];
     int32 rank[1];
     int64 duration[1];
     int32 count[1];
     int32 datatype[1];
     int32 dest[1];
     int32 tag[1];
     int32 comm[1];
}
{1082 612339879 1 716 1250 20 0 2000 0}
{1082 612340004 3 636 1250 20 2 2000 0}
{1082 612341445 0 343 1250 20 1 3000 0}
{1082 612341472 2 339 1250 20 3 3000 0}
```

FIG. 5

IL-10,620

S-94,206

MPI Task 0

```
#define size 1024
int sdata[size];
int rdata[size];
MPI_Status status;
MPI_Request request;
int tag = 30;

/* initialization */
/* ---- blocking send-recv 0 -> 1 */
/* fill sdata */
MPI_Send (sdata, size, MPI_INT, 1,
    tag, MPI_COMM_WORLD);
/* use or overwrite sdata */

/* ---- non-blocking send recv 1->0 */

MPI_Irecv (rdata, size, MPI_INT, 1,
   tag, MPI_COMM_WORLD, &request);
/* computation excluding rdata */
MPI_Wait(&request,&status);
/* use rdata */

/* finish */
```

MPI Task 1

```
#define size 1024
int sdata[size];
int rdata[size];
MPI_Status status;
MPI_Request request;
int tag = 30;

/* initialization */
/* ---- blocking send-recv 0 -> 1 */

MPI_Recv (rdata, size, MPI_INT, 0,
   tag, MPI_COMM_WORLD, &status)
/* use rdata */

/* ---- non-blocking send recv 1->0 */
/* fill sdata */
MPI_Isend (sdata, size, MPI_INT, 0,
    tag, MPI_COMM_WORLD, &request);
/* computation excluding sdata */
MPI_Wait(&request,&status);
/* use or overwrite sdata */

/* finish */
```

FIG. 2

IL-10,620 S-94,206

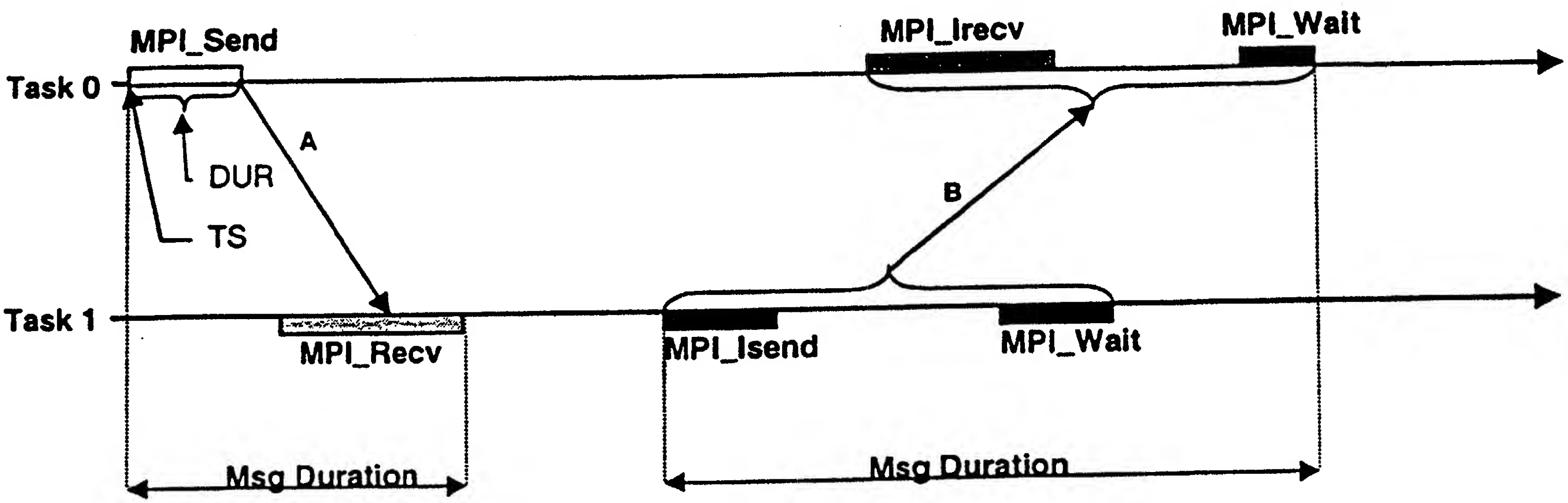

FIG. 3 A

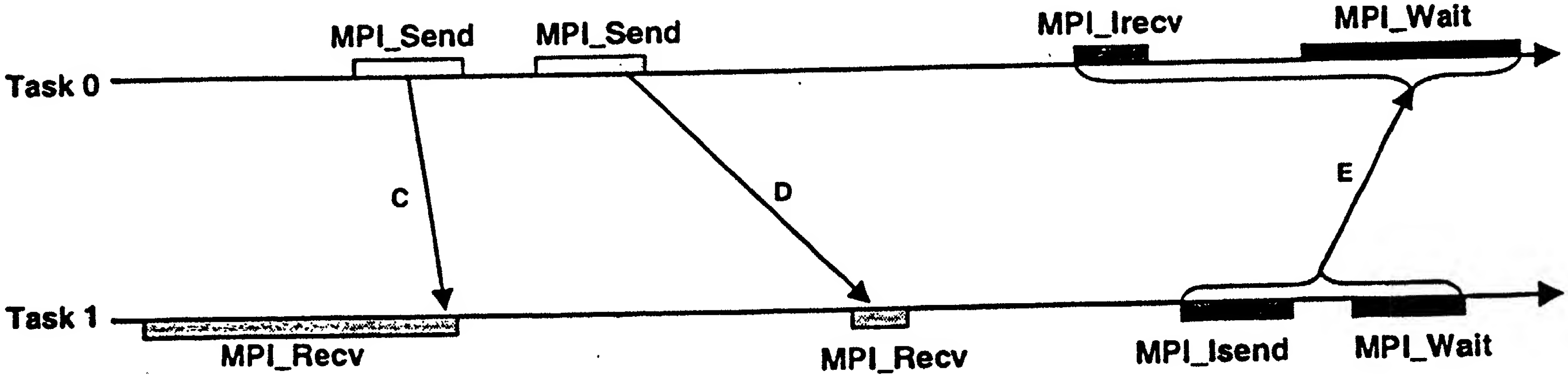

FIG. 3 B

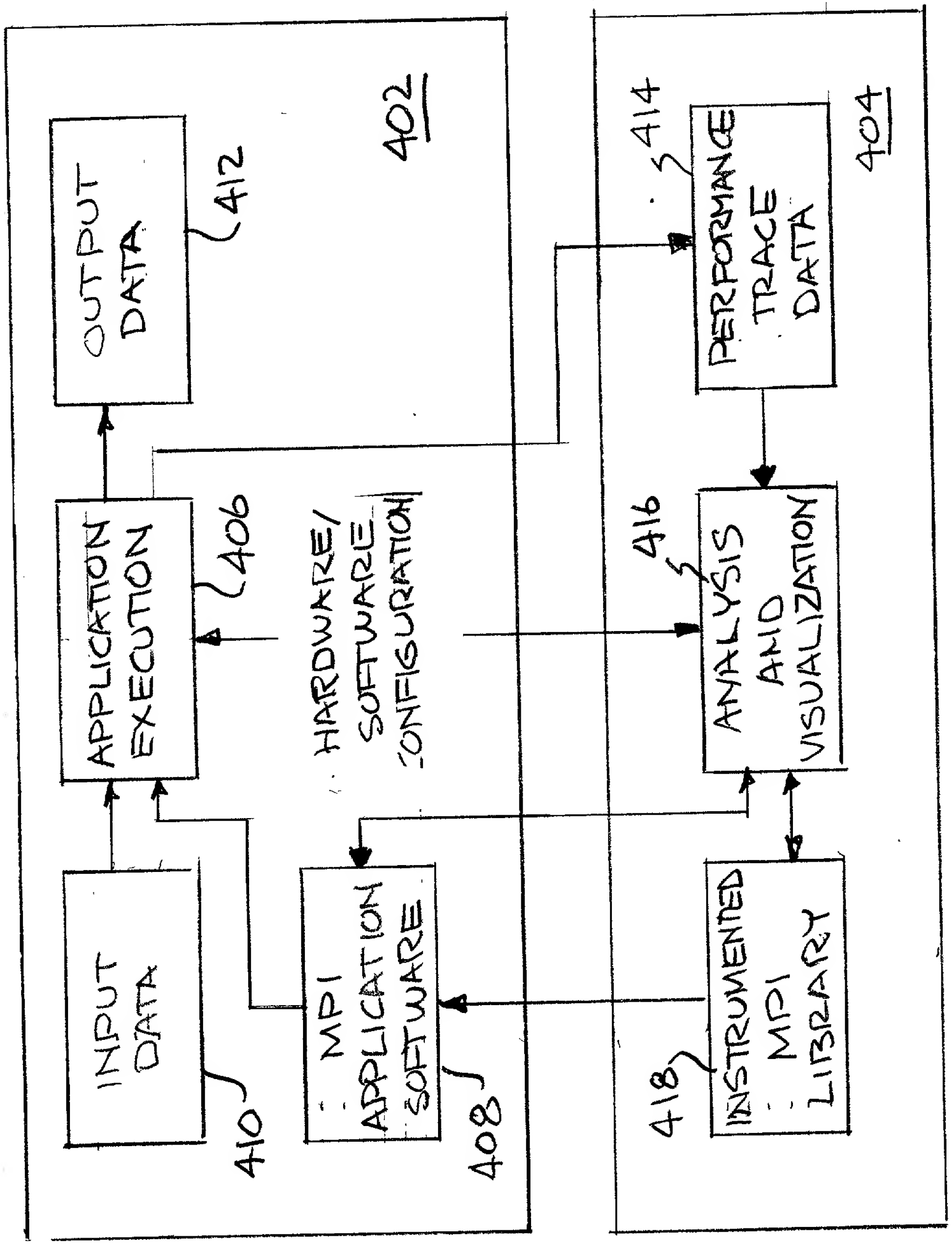
OUTPUT DATA
412
402
PERFORMANCE TRACE DATA
414
404
APPLICATION EXECUTION
406
HARDWARE/ SOFTWARE CONFIGURATION
ANALYSIS AND VISUALIZATION
416
INPUT DATA
410
MPI APPLICATION SOFTWARE
408
INSTRUMENTED MPI LIBRARY
418

FIG. 4

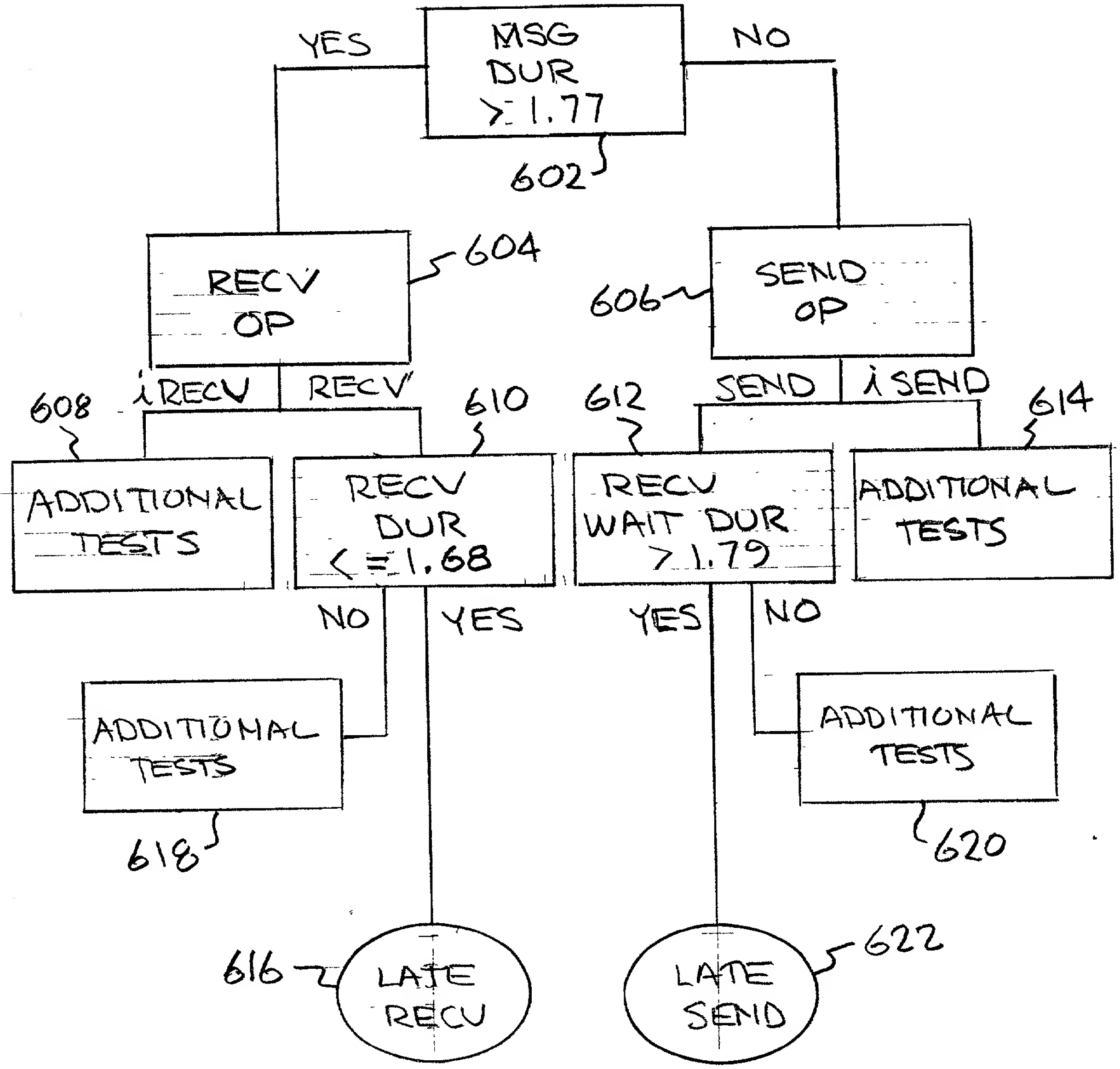
MSG DUR >1.77
602
YES
NO
RECV OP
604
SEND OP
606
i RECV
RECV
SEND
i SEND
608
610
612
614
ADDITIONAL TESTS
RECV DUR <=1.68
RECV WAIT DUR >1.79
ADDITIONAL TESTS
NO
YES
YES
NO
ADDITIONAL TESTS
618
ADDITIONAL TESTS
620
616
LATE RECV
LATE SEND
622

FIG. 6

IL-10,620 S-94,206

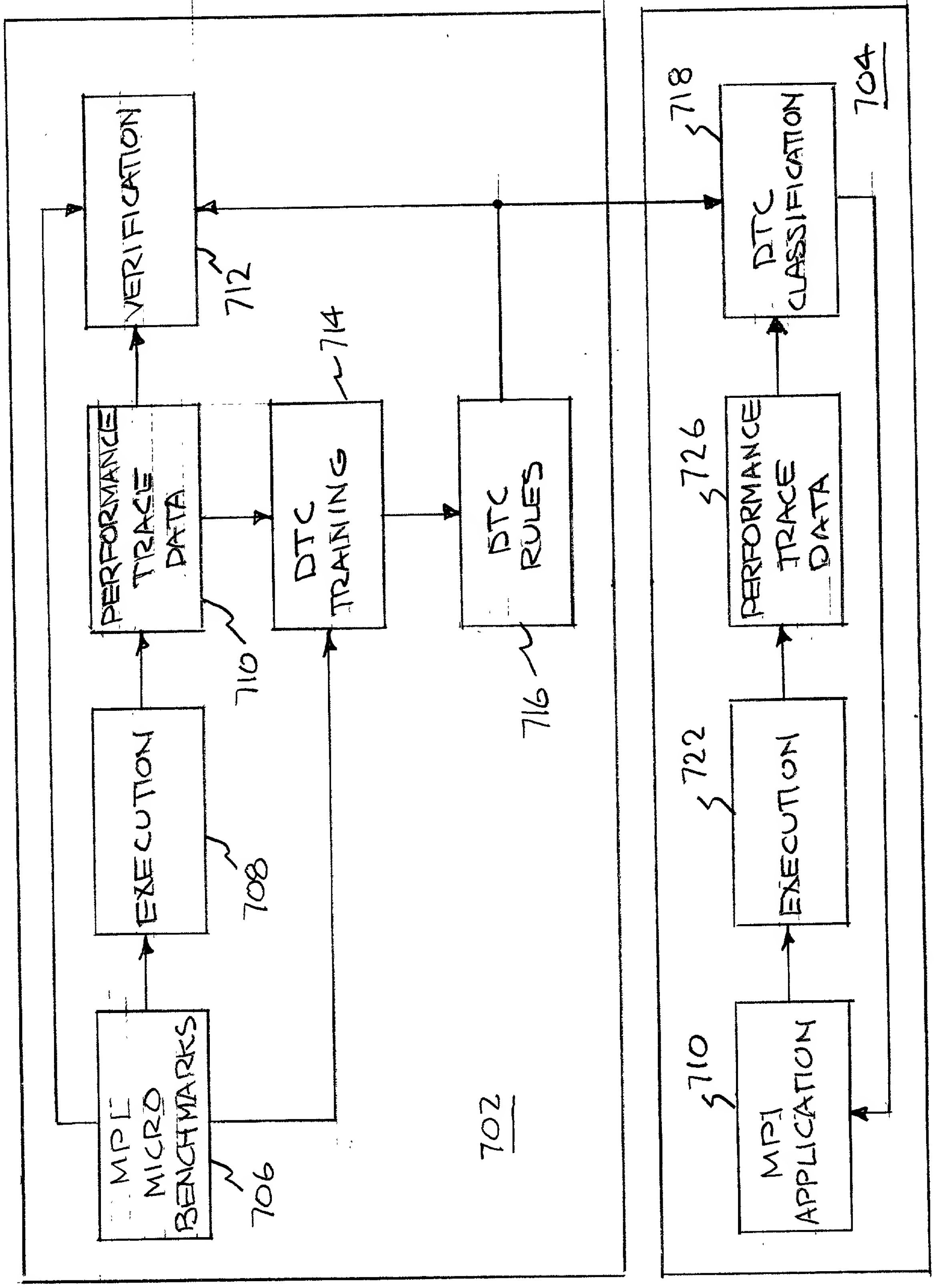

FIG. 7

IL-10,620 S-94,206

Send Type	Send Dur	Send Wait Dur	Recv Type	Recv Dur	Recv Wait Dur	Msg Size	Msg Dur	Class
send	1.06	0.00	recv	0.98	0.00	16	0.97	normal
send	1.00	0.00	recv	0.92	0.00	16	0.93	normal
isend	1.77	1.22	recv	41.49	0.00	2	0.70	late send post
isend	1.26	1.14	recv	4.50	0.00	2	0.73	late send post
isend	0.65	1.84	irecv	1.12	0.82	32768	1.83	late recv post
isend	0.93	3.15	irecv	1.29	0.87	32768	3.05	late recv post

FIG. 8

		Prediction						
		normal	late send	late recv	late recv post	late recv wait	late send post	late send wait
Actual	normal	786	4	3	3	2	14	28
	latesend	13	406	0	0	0	0	0
	laterecv	21	0	399	0	0	0	0
	laterecvpost	48	1	0	314	55	0	2
	laterecvwait	48	0	0	127	245	0	1
	latesendpost	20	0	0	0	0	397	3
	latesendwait	16	0	1	0	0	9	394

FIG. 9

IL-10,620 S-94,206

Send Type	Send Dur	Send Wait	Recv Type	Recv Dur	Recv Wait	Msg Size	Msg Dur	Class	Confidence Factor
send	2.90	0.00	irecv	2.70	1.86	1250	2.07	late recv post	0.92
send	3.35	0.00	irecv	1.21	1.60	1250	2.36	late recv wait	0.99
send	3.36	0.00	irecv	1.21	1.45	1250	2.34	late recv wait	0.99

FIG. 10

Location		Class						
Sender	Receiver	Normal	Late Send	Late Recv	Late Send Post	Late Send Wait	Late Recv Post	Late Recv Wait
copy_faces+4268	copy_faces+3980	2	0	0	34	0	0	1572
x_solve+7716	x_solve+888	0	0	0	1600	0	0	4

FIG. 11

IL-10,620 S-94,206

Application	Trace File Size (MB)	Number of Trace Records	Normal Runtime (seconds)	MPI_Send	MPI_Recv	MPI_Isend	MPI_Irecv
CG-HEAT	2.7	39698	70	6828	148	0	6680
NAS BT	5.6	88522	1344	0	0	9672	9672
NAS SP	1.6	31394	840	0	0	19272	19272
sPPM	0.2	2066	287	0	0	480	480

FIG. 12

IL-10,620 S-94,206

Application	Sender Location	Receiver Location	Class						
			normal	late send	late recv	late send post	late send wait	late recv post	late recv wait
NAS BT	copy_faces+4056	copy_faces+3636	795	0	0	2	0	11	0
	copy_faces+4000	copy_faces+3696	0	0	0	755	0	0	53
	copy_faces+4168	copy_faces+3756	2	0	0	22	0	0	784
	copy_faces+4112	copy_faces+3816	3	0	0	6	0	0	799
	copy_faces+4280	copy_faces+3876	4	0	0	35	0	0	769
	copy_faces+4224	copy_faces+3936	3	0	0	27	0	0	778
	x_send_solve_info+612	x_receive_solve_info+124	804	0	0	0	0	0	0
	x_send_backsub_info+432	x_receive_backsub_info+120	0	0	0	28	162	0	614
	y_send_solve_info+608	y_receive_solve_info+124	804	0	0	0	0	0	0
	y_send_backsub_info+420	y_receive_backsub_info+120	0	0	0	35	208	0	561
	z_send_solve_info+908	z_receive_solve_info+124	804	0	0	0	0	0	0
	z_send_backsub_info+348	z_receive_backsub_info+120	0	0	0	21	183	0	600
9672			3219	0	0	931	553	11	4958
NAS SP	copy_faces+4100	copy_faces+3680	1575	0	0	6	0	27	0
	copy_faces+4044	copy_faces+3740	0	0	0	1474	0	1	133
	copy_faces+4212	copy_faces+3800	6	0	0	22	0	0	1580
	copy_faces+4156	copy_faces+3860	3	0	0	17	0	0	1588
	copy_faces+4324	copy_faces+3920	0	0	0	33	0	0	1575
	copy_faces+4268	copy_faces+3980	2	0	0	34	0	0	1572
	x_solve+7716	x_solve+888	0	0	0	1600	0	0	4
	x_solve+17864	x_solve+8272	0	0	0	1604	0	0	0
	y_solve+7632	y_solve+872	0	0	0	1602	0	0	2
	y_solve+17236	y_solve+8180	0	0	0	1604	0	0	0
	z_solve+7612	z_solve+912	0	0	0	1603	0	0	1
	z_solve+17224	z_solve+8184	0	0	0	1604	0	0	0
19272			1586	0	0	11203	0	28	6455
CG HEAT	snd_int+80	rcv_int+128	141	3	4	0	0	0	0
	snd_r8+80	rcv_asynch_r8+136	1396	2321	0	4	0	819	-2140
6828			1537	2324	4	4	0	819	2140
SPPM	xbdrys+1248	xbdrys+152	40	0	0	0	0	0	0
	xbdrys+1184	xbdrys+212	40	0	0	0	0	0	0
	xbdrys+6028	xbdrys+288	29	0	0	0	10	0	1
	xbdrys+5960	xbdrys+356	6	0	0	12	12	0	10
	ybdrys+1248	ybdrys+152	40	0	0	0	0	0	0
	ybdrys+1184	ybdrys+212	40	0	0	0	0	0	0
	ybdrys+6588	ybdrys+288	31	0	0	0	9	0	0
	ybdrys+6520	ybdrys+356	8	0	0	10	9	0	13
	zbdrys+6268	zbdrys+288	19	0	0	0	19	0	2
	zbdrys+6200	zbdrys+356	14	0	0	16	5	0	5
	zbdrys+10920	zbdrys+432	33	0	0	0	7	0	0
	zbdrys+10852	zbdrys+500	12	0	0	17	4	0	7
480			312	0	0	55	75	0	38

FIG. 13